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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 10/568,126
Filing Date: February 14, 2006
Appellant(s): MASUDA ET AL.

Neil Bartfeld
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed June 3, 2008 appealing from the Office action mailed December 5, 2007.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

No evidence is relied upon by the examiner in the rejection of the claims under appeal.

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 13-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over BASSETT et al (5,145,763) in view of MIZUTA et al (6,869,742) **further in view of LEE et al (2003/01655770)**, with the combination of KOMANO (4,847,178), NISHIO et al (6,010,816) and MISUMI et al (2003/0059706).

The claimed invention is drawn to the following:

13. (New) A positive photoresist composition formed by dissolving (A) photosensitive novolak resin comprising an alkali soluble novolak resin wherein 3 to 7 mol% of hydrogen atoms within those of all phenolic hydroxyl groups of the alkali soluble novolak resin are substituted by 1,2-naphthoquinone diazide sulfonyl groups, wherein the alkali soluble novolak resin before substitution by 1,2-naphthoquinone diazide sulfonyl groups has been fractionated by weight to produce a degree of dispersion of 2.2 to 2.8, in (B) an organic solvent comprising 70 to 90% by weight of a propylene glycol alkyl ether acetate, and ethyl lactate.

BASSETT et al discloses a positive resist composition comprising a reaction product of a novolak resin and a naphthoquinonediazide sensitizer. The solvent used to formulate the composition is disclosed column 8, lines 58-66 which include propylene glycol monomethyl ether acetate, and mixtures with those other listed solvents thereof. The o-quinone diazide compound is reacted in an amount of 5 to 10% based on the theoretical molar level of hydroxyl groups in the resin, thus the endpoints of the preferred range fall within the claimed range of the claimed proportions of the substituted hydrogen atoms as recited in claim 2. The method as

claimed in claim 7 is met by the disclosure in column 9, lines 7-29 wherein the composition is coated, baked, exposed and developed.

MIZUTA et al discloses a positive photoresist composition comprising a photosensitive novolak resin, a quinone diazide sulfonyl ester compound and a sensitizer. The novolak resin used to form the photosensitive resin is found in column 10, lines 33-35 wherein said Mw/Mn of the novolak resin is in range from 2.2 to 2.8. The percentage of the hydrogens substitute with a naphthoquinonediazide sulfonyl group on the novolak resin is disclosed to be 3.8% as seen in column 11, lines 39-41, which falls in the recited range as now recited in new claims 8 and 9.

Newly cited reference to LEE et al addresses the new limitation recited in claim 13 wherein the organic solvent is 70-90% by weight of propylene glycol alkyl ether acetate, and ethyl lactate. Applicants are directed to LEE et al page 5, paragraph [0042] wherein the organic solvent is disclosed to be "More preferably, PGMEA alone or a mixture of PGMEA and EL in a ratio of 9:1 to 7:3 by weight..." This clearly suggest the ratio of the claimed solvent mixture as recited in claim 13 and motivates the skilled artisan to use such a mixture of solvents with the reasonable expectation of forming a photoresist composition which is uniform in layer thickness and critical in dimension.

Each of the following newly cited prior art references disclose the use of acrylate polymers as good plasticizers in photoresist compositions with quinone diazide containing photosensitive ingredients, see column 3, lines 38-40 in KOMANO (4,847,178), column 7, lines 11-18 in NISHIO et al (6,010,816) and paragraph [0023] – [0029] in MISUMI et al (2003/0059706).

It would have been *prima facie* obvious to one of ordinary skill in the art of positive photoresist compositions to substitute the novolak resin in MIZUTA et al as the photosensitive novolak resin in BASSETT et al and reasonably expect same or similar results as disclosed in BASSETT et al high resolution, sensitivity and definition. It would also have been *prima facie* obvious to one of ordinary skill in the art positive photoresist compositions to have a reaction percentage of about 3.8% of the hydrogen atoms on the novolak resin for the photoresist resist composition as recited in MIZUTA et al and expect same or similar results such as disclosed in MIZUTA et al

Finally it would have been *prima facie* obvious to the skilled artisan to add a known plasticizer such as acrylate polymers into the composition and reasonably expect excellent coating properties, flexibility and anti-abrasion properties to the photoresist composition.

And it would have been *prima facie* obvious to the skilled artisan to use a solvent mixture as recited in LEE et al wherein the ratio of PGMEA to ethyl lactate (EL) is 9:1 to 7:3 and reasonably expect same or similar results as recited in LEE et al for forming a photoresist composition which is uniform in layer thickness and critical in dimension.

3. Claims 13-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over OKAZAKI et al (5,422,221) in view of NISHI et al (5,759,736), MIZUTA et al (6,869,742) **further in view of LEE et al (2003/01655770)**, with the combination of KOMANO (4,847,178), NISHIO et al (6,010,816) and MISUMI et al (2003/0059706).

The claimed invention has been recited above and is included by reference.

OKAZAKI et al discloses a positive photoresist composition comprising a photosensitive novolak resin having 3% to 27 mol percent of the hydrogen atoms on the resin replaced with a 1,

2-naphthoquinonediazide-sulfonyl group, see column 2, line 49- column 3, line 2. The resin used in the condensation reaction has a weight average molecular weight of 1,000 to 10,000.

OKAZAKI et al lacks a working example comprising a photoresist composition comprising a mixture of an ethyl lactate solvent and a propylene glycol alkyl ether acetate mixture as recited in claim 6.

NISHI et al disclose positive working photoresist compositions comprising novolak resin, which has been esterified with a quinonediazide compound and dissolved in a solvent mixture of ethyl lactate and propylene glycol monomethyl ether acetate. The use of a mixture of solvents is known and disclosed in column 6, line 49 – column 7, line 10 and include ethyl lactate and propylene glycol monomethyl ether acetate, in fact Example 1 uses that exact solvent mixture, see column 8, lines 20-40.

MIZUTA et al discloses a positive photoresist composition comprising a photosensitive novolak resin, a quinone diazide sulfonyl ester compound and a sensitizer. The novolak resin used to form the photosensitive resin is found in column 10, lines 33-35 wherein said Mw/Mn of the novolak resin is in range from 2.2 to 2.8. The percentage of the hydrogens substitute with a naphthoquinonediazide sulfonyl group on the novolak resin is disclosed to be 3.8% as seen in column 11, lines 39-41, which falls in the recited range as now recited in new claims 8 and 9.

Newly cited reference to LEE et al addresses the new limitation recited in claim 13 wherein the organic solvent is 70-90% by weight of propylene glycol alkyl ether acetate, and ethyl lactate. Applicants are directed to LEE et al page 5, paragraph [0042] wherein the organic solvent is disclosed to be “More preferably, PGMEA alone or a mixture of PGMEA and EL in a ratio of 9:1 to 7:3 by weight...” This clearly suggest the ratio of the claimed solvent mixture as

recited in claim 13 and motivates the skilled artisan to use such a mixture of solvents with the reasonable expectation of forming a photoresist composition which is uniform in layer thickness and critical in dimension.

Each of the prior art references disclose the use of acrylate polymers as good plasticizers in photoresist compositions with quinone diazide containing photosensitive ingredients, see column 3, lines 38-40 in KOMANO (4,847,178), column 7, lines 11-18 in NISHIO et al (6,010,816) and paragraph [0023] – [0029] in MISUMI et al (2003/0059706).

It would have been *prima facie* obvious to one of ordinary skill in the art of positive working photoresist compositions to use a mixture ethyl lactate and polypropylene glycol monomethyl ether acetate to dissolve the components of OKAZAKI et al and reasonably expect same or similar results with respect to smooth coating properties and excellent storage stability. It would also have been *prima facie* obvious to one of ordinary skill in the art of positive photoresist composition to substitute the novolak resin in MIZUTA et al as the photosensitive novolak resin in BASSETT et al and reasonably expect same or similar results as disclosed in BASSETT et al high resolution, sensitivity and definition and have a reaction percentage of about 3.8% of the hydrogen atoms on the novolak resin substituted with a naphthoquinonediazide sulfonyl group and expect same or similar results such as disclosed in MIZUTA et al.

Finally it would have been *prima facie* obvious to the skilled artisan to add a known plasticizer such as acrylate polymers into the composition and reasonably expect excellent coating properties, flexibility and anti-abrasion properties to the photoresist composition.

And it would have been prima facie obvious to the skilled artisan to use a solvent mixture as recited in LEE et al wherein the ratio of PGMEA to ethyl lactate (EL) is 9:1 to 7:3 and reasonably expect same or similar results as recited in LEE et al for forming a photoresist composition which is uniform in layer thickness and critical in dimension.

4. Claims 13-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over MIZUTA et al. **further in view of LEE et al (2003/01655770).**

The claimed invention has been recited above and is included by reference.

MIZUTA et al discloses a positive photoresist composition comprising a photosensitive novolak resin, a quinone diazide sulfonyl ester compound and a sensitizer. The novolak resin used to form the photosensitive resin is found in column 10, lines 33-35 wherein said Mw/Mn of the novolak resin is in range from 2.2 to 2.8. The percentage of the hydrogens substitute with a naphthoquinonediazide sulfonyl group on the novolak resin is disclosed to be 3.8% as seen in column 11, lines 39-41, which falls in the recited range as now recited in new claims 8 and 9.

MIZUTA et al discloses use of solvents for formulating the recited photoresist to included polypropylene glycol monomethyl ether acetate in column 8, lines 54-55 among other solvents.

Newly cited reference to LEE et al addresses the new limitation recited in claim 13 wherein the organic solvent is 70-90% by weight of propylene glycol alkyl ether acetate, and ethyl lactate. Applicants are directed to LEE et al page 5, paragraph [0042] wherein the organic solvent is disclosed to be "More preferably, PGMEA alone or a mixture of PGMEA and EL in a ratio of 9:1 to 7:3 by weight..." This clearly suggest the ratio of the claimed solvent mixture as recited in claim 13 and motivates the skilled artisan to use such a mixture of solvents with the

reasonable expectation of forming a photoresist composition which is uniform in layer thickness and critical in dimension.

Each of the following prior art references disclose the use of acrylate polymers as good plasticizers in photoresist compositions with quinone diazide containing photosensitive ingredients, see column 3, lines 38-40 in KOMANO (4,847,178), column 7, lines 11-18 in NISHIO et al (6,010,816) and paragraph [0023] – [0029] in MISUMI et al (2003/0059706)

It would have been *prima facie* obvious to one of ordinary skill in the art of positive working photoresist compositions to use a mixture ethyl lactate and polypropylene glycol monomethyl ether acetate or polypropylene glycol monomethyl ether acetate alone to dissolve the components such as the novolak resin having a degree of dispersion of 2.2 to 2.8 as well as have about 3.8% of the hydrogen atoms on the novolak resin substituted with a naphthoquinonediazide sulfonyl group and expect same or similar results such as disclosed in MIZUTA et al. for high resolution, sensitivity and definition

Finally it would have been *prima facie* obvious to the skilled artisan to add a known plasticizer such as acrylate polymers into the composition and reasonably expect excellent coating properties, flexibility and anti-abrasion properties to the photoresist composition.

And it would have been *prima facie* obvious to the skilled artisan to use a solvent mixture as recited in LEE et al wherein the ratio of PGMEA to ethyl lactate (EL) is 9:1 to 7:3 and reasonably expect same or similar results as recited in LEE et al for forming a photoresist composition which is uniform in layer thickness and critical in dimension.

(10) Response to Argument

In each of the rejections provided above, the examiner has attempted to show that the claimed invention reciting a solvent blend is *prima facie* obvious to the skilled artisan and disclosed in the prior art when used to formulate photoresist compositions comprising photosensitive novolak resins which have been substituted (esterified) with a 1,2-naphthoquinone diazide sulfonyl group at a rate of 3% to 7% , having a degree of dispersion (polydispersity) of 2.2 to 2.8. This solvent blend has been disclosed through the history of the art as seen in the variation of the dates of the prior art references used. The particular percentage blend of the polyethylenic glycol monomethyl ether acetate (PGMEA) with ethyl lactate at a weight percent of 9:1 to 7:3, respectively is clearly taught in the art of LEE et al (2003/0165570) page 5, paragraph [0042] directing the skilled artisan to use such weight percentage blends.

The examiner believes a *prima facie* case of obviousness have been made with respect to the claims recited.

As far as secondary considerations are concerned, if applicant can show unexpected results with respect to the claimed invention over the closest prior art disclosures, ground for patentability may be present. In the current case, the examiner believes this showing has not been met for the following reasons:

(1). The use of the blended solvent of PGMEA and ethyl lactate is not an unexpected result over PGMEA alone, based on TABLE 1.

In Examples 1 and 2 the evidence shows that Example 1 (PGMEA alone) has excellent developability, sensitivity and resist form with a rating of "A" meaning $80^\circ < \theta$ for the top of the resist pattern and has a rating of "B" for heat resistance meaning $80^\circ \geq \theta$. The unexpected

results are not clearly established because of the lack of specificity of the evidence. For instance if the heat resistance PGMEA alone is 80° and the heat resistance for the PGMEA/ethyl lactate blend is 81° for θ , there can be no "unexpected result" for the heat resistance between the two solvents examples. Applicants need more specific evidence to distinguish how the results are unexpected.

(2). The beneficial results of the now claimed invention was not the original intent disclosed in the specification.

The intent of the patent as disclosed in the ABSTRACT of the invention states that "the means for increasing development velocity of positive photoresist composition is provided...". The use of PGMEA alone gives this increased velocity as seen in Example 1, TABLE 1, page 11 of the US Patent Application Publication, while the claimed invention to the PGMEA/ethyl lactate blend give an inferior development velocity, see Example 2, Table 1. Appellants are now asserting that the heat resistance of the pattern image is unexpected based on the evidence in Table 1, however that data is not specific enough to establish that the heat resistance is truly unexpected due to presentation of the data. The data as presented shows a range of the substrate interface and the side wall angle to be $80^\circ < \theta$ for "A" and $80^\circ \geq \theta$ for "B". Several scenarios can be established as stated above to show how the angle θ may not be an unexpected value.

In conclusion, the examiner believes that the evidence fails to rise to the level of unexpected results with respect to the data of record for the claimed blend of PGMEA/ethyl lactate and the PGMEA alone samples. Thus the examiner requests that the BOARD affirm the final rejection outstanding in the case.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/John S. Chu/

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